|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Table 1 Scale Factor = 1km = 100,000cm** | | | | |  |
| **Object** | **Real Diameter (km)** | **Real Distance (km)** | **Scaled Size Diameter (cm)** | **Scaled Distance (m)** | **Location of Scaled Dist.?** |
| **Sun** | 1,392,000 | Our starting point! | 60 | Our starting Point! | Freshman Center |
| **Mercury** | 4880 | 5.8 x107 |  |  |  |
| **Venus** | 12,104 | 1.1 x108 |  |  |  |
| **Earth** | 12,742 | 1.5 x108 |  |  |  |
| **Mars** | 6780 | 2.3 x108 |  |  |  |
| **Jupiter** | 139,822 | 7.8 x108 |  |  |  |
| **Saturn** | 116,464 | 1.4 x109 |  |  |  |
| **Uranus** | 50,724 | 2.9 x109 |  |  |  |
| **Neptune** | 49,248 | 4.5 x109 |  |  |  |
| **Pluto** | 2274 | 5.9 x109 |  |  |  |
| **Proxima Centauri (nearest star)** | 375,840 | 4.1 x1013 |  |  |  |
| **Galactic Center** | XXXX | 2.6 x1017 | XXXX |  |  |

**Overview:**

One way to gain a sense of the distances between things is to use a proportional (scaled) model. In such a model, everything is reduced by the same amount, so all parts of the model relative to each other are of the same proportional size. (In the same way a good trail map you use for hiking or the road map you use for driving is a flat scaled model of the terrain you are moving over.) To create a scale model, divide all of the actual distances or sizes by the same scale factor:

**scaled size = (actual size)/(scale factor)**

**scaled distance = (actual distance)/(scale factor)**

For our scale model, let’s use a circle about 60 centimeters (about 30 inches) across to represent the Sun. Since the real Sun is 1,392,000 kilometers (865,000 miles) across, the scaled model has all of the planets and distances reduced by an amount equal to (139,200,000,000 /60). Complete that simple division problem to figure the scale factor you will use for the rest of this lab. You will calculate the scaled sizes and distances to the other objects in **Table 1** using the procedure outlined above. You will also make “to scale” representations of the sizes of the objects listed in **Table 1.** Furthermore, you will use Google Earth (ruler function) to determine the location of each scaled object were we to plot the scaled distances, recording these locations in **Table 1** and on each representation (cutout).

\*Note: because we are scaling down the actual sizes of object to centimeters, we must convert our actual distances to centimeters BEFORE finding the scaled distances. Conversion factors are given for each table.

**Objective:** To determine the scale factor for use in this lab, calculate the scaled sizes and distances of celestial bodies in **Table 1,** and create scaled representations of the sizes and distances of those objects.

**Procedure:**

1. Determine the scale factor for this lab, check w/ Mr. Wallace. Hint: if you are clueless, re-read the overview!
2. Calculate the scaled sizes/distances for objects listed in **Table 1** using the scaled factor. Remember to convert to **cm** before figuring the scaled sizes/distances!
3. Log-on to your net-books and open the Google Earth program. Use this program to determine the locations of the scaled distances from the FC. Use the ruler function.

* Start 🡪 Programs 🡪 Google Earth Folder 🡪 Google Earth
* Type in “Quakertown, PA” in the *fly to* search window.
* Locate the FC
* Click the ruler icon in the tool bar
* Change the units to meters
* Click in-front of the FC and then move your mouse to stretch the ruler to the desired length – then click again. Describe the location, ie: flag pole, on S 9th Street, football field/track, skate park. As you adjust the ruler line for the various scaled distances, describe each objects scaled location if the Sun were located at the FC.

1. Using a ruler/meter stick and scissors cut out circles from construction paper/butcher paper to represent the scaled sizes of the objects from **Table 1**. **Clearly label** each cut out with the object it represents and the location of the scaled distance (if it’s too small then create arrow that points to it and write your info on the arrow) – *be creative!* Use markers, colored pencils, paper shapes, draw faces, pictures, whatever! Just make each representation interesting to view.

**Materials:**

* Scissors
* Ruler
* Butch Paper/Construction Paper
* Markers, Colored Pencils, etc.
* Calculator
* Net-book

**Post Lab Questions (answer on the back of the Table sheet):**

1. How many times larger is the *real* Jupiter than its representation in our scale model?

2. The fastest plane can travel at about 4400 kilometers/hour. How long would it take to travel to the Sun? Convert your answer to the number of days and then the number of years. (The time it takes to travel a given distance = (distance travelled)/speed, or *t = D/v*.)

3. How can we hope to one day explore outer space, when the distances between the stars are so vast?